Gold in the News

Interesting news stories featuring gold

Gold in Retro-Reflector

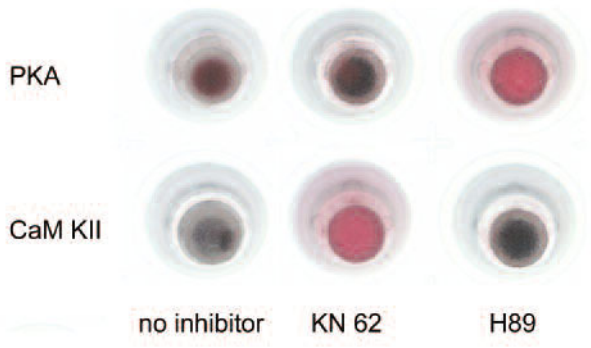
A group from the Commonwealth Scientific and Industrial Research Organisation, Australia have reported the use of gold coatings for cube-corner retro-reflectors in The Space Interferometry Mission (SIM) PlanetQuest (managed by the Jet Propulsion Laboratory for the National Aeronautics and Space Administration). In their work reported in the Proceedings of SPIE-The International Society for Optical Engineering, they report that a test device has recently been fabricated for this project with demanding specifications on the optical surfaces and gold reflective coatings.

Several gold deposition techniques were examined to meet the stringent specifications on uniformity, optical properties, micro-roughness and surface quality. They report on a comparative study of optical performance of gold films deposited by resistive and e-beam evaporation, including measurements of the scattering from the coated surfaces. The effects of oxygen bombardment and titanium under-layer on optical properties and adhesion were also evaluated.

High Throughput Drug Screening Using Gold

According to *Chemistry World*, UK researchers have developed a system for assessing the activity of a crucial class of enzymes involved in cellular signalling pathways. The enzymes, called kinases, are central to many metabolic processes, making them key drug targets. The system could lead to high-throughput screening of potential kinase inhibitors, say its developers.

The researchers at the University of Liverpool, previously demonstrated that spherical gold nanoparticles could be stabilised in solution and coated with oligopeptides, giving them the appearance and properties of a protein. Now, the team, led by Mathias Brust and David Fernig, has incorporated the nanoparticles into an assay for kinase inhibition.



Picture courtesy of Mathias Brust

The technique can best be illustrated using the example above which shows samples of two kinases, PKA and CaM KII, being tested against two inhibitor compounds called KN 62 and H89, respectively. With no inhibition, i.e. kinase activity, there is the indication of dark blue to black coloration followed by precipitation. When inhibition occurs, i.e. there is no kinase activity, it is indicated by the red colour of the original unreacted nanoparticle solution. The results show, as expected, inhibition of PKA by H89 and inhibition of CaM KII by KN 62. The researchers believe that this approach could now be employed to test a large number of potential inhibitors simultaneously against many different kinases. This could lead to the use of gold nanoparticles in high-throughput drug discovery. For more information see www.rsc.org/chemistryworld/News/2006/February/03020602.asp

Biocompatibility of Gold Nanoparticles

Interesting new results have been published that have implications on the use of gold nanoparticles as a delivery vehicle into target cells for clinical applications. It has been found that gold nanoparticles do not affect the global transcriptional program of human umbilical vein endothelial cells (HUVECs) using a DNA-microarray analysis. The work published in the *Journal of Biomedical Nanotechnology* suggests a lack of a direct effect of gold nanoparticles on the overall physiology of HUVECs. The results are a very useful contribution to the debate about the long term effects on health and environmental impact of any type of nanomaterials.

Most Expensive British Gold Coin

An Anglo Saxon gold coin costing more than £350,000 has been bought by the British Museum. Costing £357,832, it is the most expensive British gold coin purchased and is thought to be the earliest example of a gold coin showing an English ruler minted as circulating currency.

Weighing in at 4.24 grams, the coin depicts King Coenwulf of Mercia who ruled an area of the UK stretching from the Humber to the Thames and Welsh borders during the early 9th century. The gold coin was discovered in 2001 on the banks of the River Ivel in Bedfordshire by an amateur treasure hunter with a metal detector. It was brought by an American buyer but came up for sale again last year.

There are only eight known gold coins dating back to the mid-to-late Saxon period, seven of which are now owned by the museum.

Gold Salts Autism Cure Tested

Mady Hornig from Columbia's Mailman School of Public Policy is to test whether gold salts can improve the functioning of "autistic mice", the United Press International reports. Dr Hornig has bred a group of mice with a susceptibility to thimerosal, which was widely used in children's immunisations and is thought by many to be linked to the rise in autism. Dr Hornig will see whether treatment with gold salts improves the mice's functioning. If the results are positive, it could have implications for the treatment of autism in children.

Previous studies have shown that treating mice with thimerosal leads them to exhibit autistic-like symptoms. A 12-year-old boy known as Donald T was treated with gold salts in 1946 for juvenile arthritis. The gold salts cleared up the arthritis but an unexpected marked improvement in his autism was also observed. Some researchers believe that autism is caused by toxic exposure in utero or during infancy. Previous research by Boyd Haley of the University of Kentucky on the effect of gold salts on mercury found that gold salts reversed the binding of mercury to molecules.

For more information see www.upi.com/ConsumerHealthDaily/view.php?StoryID=20060202-122053-5023r

Novel Mercury Control Technologies Using Gold

As reported in the latest CATM newsletter, control of mercury emissions from coal-fired power stations is currently a hot topic in the United States. The MerCAP™ concept is to place fixed structures into a flue gas stream to adsorb mercury and then periodically regenerate them and recover the captured mercury. While a variety of regenerable sorbent materials could be used, most of the successful development work has focused on the use of gold-coated substrates in the form of parallel plates spaced about 0.5 to 1 inches apart.

Tests are being conducted by a team from corporation URS, at the Stanton and Yates Power Plants. At Stanton Station, the gold substrate was installed in one of the station's baghouse compartments. After 1700 hours of operation, mercury removal ranged from 5% to 65%. Importantly, it did not appear that non-ideal operating conditions caused permanent degradation of the gold substrate. Based on the results at the Stanton Station, thermal regeneration can be performed with minimal degradation in performance.

In a separate research project led by URS, mercury oxidation catalysts are being investigated. A number of different catalysts are being screened at Great River Energy's Coal Creek Station, City Public Service's Spruce Station, and TXU's Monticello Plant. These include several SCR catalysts, palladium catalysts (both fresh and regenerated), and gold. In general, economic analysis shows that these processes are competitive with ACI, assuming a 2-year catalyst life.

For more information see www.undeerc.org/catm/pdf/Volume12Issue1.pdf

In other work related to both gold and mercury, a group from the University of Central Florida, USA has been pushing the limits of mercury sensors with gold nanorods. The work reported the NSTI NanoTech 2006 event in Boston describes a direct way to determine mercury in tap water samples at the parts-per-trillion level. Its outstanding selectivity and sensitivity results from the well-known amalgamation process that occurs between mercury and gold. The entire procedure takes less than 10 minutes. No sample separation and/or sample pre-concentration is required. The only step prior to mercury determination consists of mixing the water sample with a gold nanorod solution in sodium borohydride. The analytical figures of merit demonstrate precise and accurate analysis at the parts-per-trillion level. The technique shows excellent potential for monitoring ultra-low levels of mercury in water samples.

See www.nsti.org/Nanotech2006/ for more information.

Novel Catalyst for Selective Oxidation of CO in Hydrogen

Scientists at Leiden University have developed a novel catalyst to selectively reduce CO levels in the presence of H_2 at temperatures and conditions well suited to hydrogen production in industrial applications.

The group have discovered that a catalyst comprising gold particles dispersed on an alumina or zirconia support combined with CeO_x and Li_2O can selectively oxidise CO into CO_2 in the presence of H_2. The multicomponent catalyst almost completely converts CO into CO_2 at 50°C. Most importantly, the CO conversion remains stable at almost 100% at temperatures relevant to hydrogen-air polymer electrolyte membrane (PEM) fuel cells, i.e., between 60 and at least 150°C, while the selectivity to CO_2 decreases only slightly. In addition, they showed that the catalyst performs better than any other available catalysts under conditions relevant for industrial application, such as high H_2 and O_2 concentrations and high flow rates.

A European Patent has now been filed by the group and the University is seeking commercial partners for collaborative development or licensing of this platform technology. For more information contact Dr A Gluhoi, email gluhoi@chem.leidenuniv.nl

Editor's note: *We welcome reader's suggestions for items to be included in this feature. Contact: editor@goldbulletin.org*